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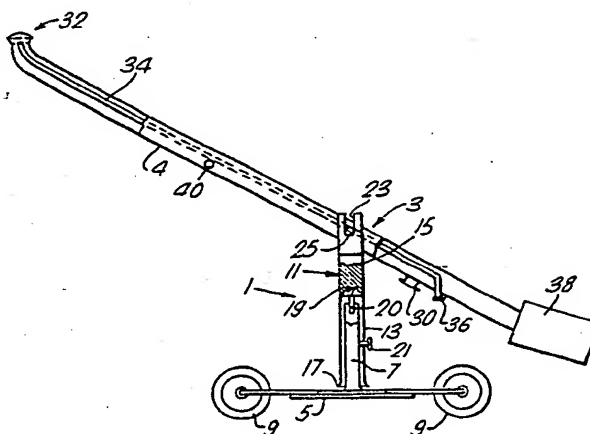


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<p>(21) International Application Number: PCT/GB89/00585 (22) International Filing Date: 26 May 1989 (26.05.89) (30) Priority data: 8812608.1 27 May 1988 (27.05.88) GB (71) Applicant (for all designated States except US): FIELD-MARK DESIGNS LIMITED [GB/GB]; Rembark House, 810 Romford Road, London E12 5JG (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): MCSHANE, Gerald, Paul [GB/GB]; 53 Winchelsea Road, Tottenham, London N17 6XJ (GB). (74) Agents: WILLIAMS, Trevor, John et al.; J.A. Kemp & Co, 14 South Square, Gray's Inn, London WC1R 5EU (GB).</p>		<p>(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB, GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published With international search report.</p>

(54) Title: SPRAYING APPARATUS



(57) Abstract

Apparatus for spraying a material such as an industrial, agricultural or building coating such as concrete comprises a wheeled or tracked trolley (1) which may be hand-pushed or motor-driven and a boom (3) carrying a sprayhead (32) at one end and a counter-weight (38) at the other end. Coating substances are supplied to the sprayhead (32) via the hollow interior of the boom and are sprayed using a compressed gas. The spray head (32) is formed by a flared bowl (37) on the end of the boom closed by a removable plastic cap (33) including the spraying aperture (35). The boom (3) may be telescopic or different length booms may be provided and the boom is pivotally supported on a vertical support shaft (11) which may be telescopic or different length shafts may be provided.

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SPRAYING APPARATUS

This invention relates to spraying apparatus and, more especially, to apparatus which is suitable for spraying building materials such as concrete or plaster.

Coating materials such as concrete or plaster used
5 in the building trade are conventionally applied to surfaces using hand tools. These hand processes require a certain degree of skill and are not particularly efficient where large surface areas need to be covered, especially where time is limited. Furthermore, in recent years a method of
10 construction of floors and ceilings of buildings has been used in which the floor/ceiling structure is a composite structure comprising steel rods and concrete with wood wool wadding inserts. It has been found, however, that with this sort of construction, there is a tendency for the concrete
15 to recede from the steel rods into the wood wool wadding leaving the steel rods exposed. This can be dangerous because the rods are exposed to corrosion and are also liable to buckle in a fire. Buildings of this type have in some cases been demolished because the only way of
20 alleviating the problem is to force new concrete into the gaps which have formed, often from below, and this has had to be done by hand, making the process time consuming and so labour intensive as to be uneconomic. Accordingly there is a need for a means by which such new concrete can be applied
25 cheaply and easily.

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According to the present invention there is provided apparatus for applying a coating to a surface comprising a mobile carriage and a boom mounted on the carriage, the boom carrying a spray head adapted to be supplied, in use, with the material to be applied as the coating and adapted to spray the material on to the surface to be coated.

Thus with the present invention a suitable building material such as concrete or plaster is sprayed on to the surface from an easy to handle and mobile apparatus. Large areas can be covered easily and quickly even in the case of ceilings. An early prototype of the apparatus has been used experimentally on a building suffering from the construction defects mentioned above and resulted in the completion in two weeks of work which would have previously taken up to three months.

The apparatus is capable of applying many forms of industrial, agricultural and domestic coatings to various surfaces.

The boom may be hollow and the coating substance is supplied to the spray head through the inside of the boom, or may be supplied via a pipe attached to the boom, and is ejected from the spray head by a compressed gas, conveniently air, from a gas supply line running alongside the boom, or possibly also inside. The boom may be formed from a number of sections telescoped together so that its length may be adjusted. Such adjustment may simply be by hand or the apparatus may be constructed to be adjusted by

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other means, for example mechanically, electrically, hydraulically or pneumatically.

Conveniently the carriage may comprise a trolley on which is mounted a vertically extending support shaft which carries the boom, the boom being mounted on the shaft for pivotal motion in a vertical plane and the shaft being mounted on the trolley for rotation about a vertical axis. This allows the spray head to be moved in any direction. The rotational freedom of the support shaft may be achieved by providing the support shaft with a hollow lower section forming a sleeve which fits over a vertically extending column on the trolley. The advantage of this arrangement is that coating substance falling from the surface being coated does not foul the mounting.

Preferably the trolley is wheeled or tracked and it may be provided with a motor e.g. on air, diesel, petrol or electric motor so that the operator does not have to push the trolley. The boom may also be provided with a counter-weight and/or the relative motion of the boom and support shaft may be damped so that it is easier to handle.

The spray head may comprise a chamber to which the substance and gas under pressure is supplied and an aperture allowing communication between the chamber and the atmosphere and through which the substance is forced by the gas. The chamber may be defined by a bowl shaped flare on the end of the boom, the open end of the flare being closed by a cap containing the aperture and made from plastics or

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rubber. Different designs of cap or different types of spray head may be provided to provide different shapes of the spray discharge or to cope with different substances to be sprayed.

- 5 The counter-weight may have a variable weight and/or position to allow it to be adjusted to different density spraying materials.

The invention will be further described by way of non-limitative example with reference to the accompanying 10 drawings in which:

Figure 1 is a side view of apparatus embodying the invention;

Figure 2 shows alternative parts for the apparatus of figure 1;

- 15 Figure 3 shows a part of the apparatus of figure 1;

Figure 4 is a top view of the apparatus of figure 1;

Figure 5 is a side view of part of the apparatus of figure 1;

Figure 6 show further alternative parts of the 20 apparatus of figure 1; and

Figure 7 is a cross-sectional view of a spray head used on the apparatus of figure 1.

As shown in figure 1 the spraying apparatus comprises a wheeled carriage 1 on which is pivotally mounted 25 a boom 3. The carriage 1 comprises a trolley having a base part 5 to which the wheels 9 are attached and a vertically extending column 7 on which a hollow or part-hollow shaft 11

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is mounted. At least the lower part 13 of the shaft 11 is hollow and fits over on the column 7 and is mounted on an internal pivot 19 which includes a downwardly extending pin 20 which engages a hole in the top of the column 7. Thus
5 the shaft is free to rotate on the column 7 about a vertical axis and the column 7 and mounting 19 are protected from the substance being sprayed by the sleeve-like lower part 13 of the shaft. The upper part 15 of the shaft may be hollow or solid. Mounted on the lower part 13 of the shaft is a
10 locking screw 21 which may be tightened against the column 7 to lock the shaft in any particular position or simply to damp the motion of the shaft.

The carriage 1 is provided with four wheels 9, although in an alternative embodiment, shown in figure 3,
15 three wheels may be used. The wheels are adapted to the particular conditions in which the apparatus is to be used - e.g. they may have low pressure tyres fitted if the ground is rough. The trolley may alternatively be provided with tracks.

20 In the illustrated embodiment the trolley is not powered but is simply wheeled into position and moved around by the operator. In an alternative embodiment, however, a motor is provided which may be powered, e.g. by the compressed gas used in the spraying equipment or by another
25 type of motor, so that the apparatus can be moved under power.

The boom 3 is mounted on the shaft 11 by means of a

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axle 25 retained in a slot 23 in the top of the mounting shaft. The fact that the boom is held on the shaft and in turn the shaft is held on the column 7 simply by their own weight means that the apparatus may be readily disassembled either for storage or transport and so that different length booms, as shown in figure 2, or different length shafts as shown in figure 6, may be fitted. The different length shafts and different length booms allow the apparatus to be used in a variety of locations.

10 In an alternative embodiment the boom 3 is constructed from several sections telescoped together so that its length may be varied. The shaft 11 may also be formed in this way. In both cases locking or damping means are provided so that the length of the boom or shaft do not vary during spraying.

The boom 3 comprises a hollow part 4 terminated at one end by the spray head 32 and at the other end by an inlet 30 to which the substance to be sprayed is supplied. In this embodiment the inlet 30 is disposed on the opposite side to the spray head of the boom's pivotal mounting point but in alternative embodiments it may be on the same side. The inlet 30 is adapted so that a standard pressure hose for the substance being sprayed can be connected to it. On the opposite end of the boom to the spray head there is provided 25 a counter weight 38 which may have a variable mass e.g. by the addition or subtracting of fluid, for example water or sand, and/or may have a variable position along the boom.

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The counter-weight is provided to balance the weight in the hollow part 4 of the boom of the substance being sprayed. The boom is provided with two handles 40 and 42 positioned so that the operator can easily guide the spray head.

5 In an alternative embodiment a damper may be provided to damp the relative movement of the boom and the mounting shaft. A locking screw is provided (not shown) so that the boom may be locked in a particular angular position relative to the shaft.

10 The substance is sprayed by a compressed gas, in this case, air, supplied to the spray head by an air line 34 running along side the boom and terminating in a connector 36 near to the inlet 30.

As shown in figure 7 the spray head comprises a
15 flared, bowl-like chamber formed on the end of the hollow boom and to which compressed gas is supplied via pipe 34 and the substance to be sprayed via the hollow boom 4. The bowl is capped by a rubber or plastics cap 33 held on, if necessary, by a hose clip or clamping ring (not shown) and
20 including an aperture 35 through which the substance is sprayed. In use substance supplied via the boom 4 fills the chamber 37 and is sprayed out from it by compressed gas supplied via line 34. Different caps having different apertures may be used for different spray patterns or
25 different substances. The use of a removable cap 33 allows the spray head to be cleaned easily. In an alternative embodiment where no cap is used the spray head is adapted to

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be removable for cleaning and/or to provide different spray patterns or spray different substances.

This embodiment of the apparatus is particularly useful for spraying concrete, but it is envisaged that other
5 embodiments may be used for spraying other building materials, e.g. plaster.

This apparatus is easily usable with the conventional equipment for mixing and pumping concrete (which may, for example, use a screw pump which mixes as
10 well as pumps the concrete or other material). Such equipment conventionally includes an air compressor.

Suitably the boom and trolley are constructed from aluminium although any other material can be used which is reasonably resistant from corrosion - particularly from
15 corrosion by the substances which are being sprayed.

It is also possible for the movement of the boom to be powered, for example with electrical, hydraulic or pneumatic assistance and, where a telescoping boom and/or shaft are used, for the telescoping action similarly to be
20 power actuated.

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CLAIMS

1. Apparatus for applying a coating to a surface comprising mobile carriage and a boom mounted on the carriage, the boom carrying a spray head supplied, in use, with the substance and adapted to spray the coating on to
5 the surface to be coated.
2. Apparatus according to claim 1 wherein the boom is hollow and the coating substance is supplied to the spray head through the inside of the boom.
3. Apparatus according to claim 1 or 2 wherein the
10 boom is formed from a number of sections telescoped together so that its length may be adjusted.
4. Apparatus according to claim 1 or 2 wherein the boom is removable from the carriage and a number of different lengths of booms are provided.
- 15 5. Apparatus according to any one of the preceding claims when the carriage comprises a trolley on which is mounted a support shaft carrying the boom.
6. Apparatus according to any one of claims 6 to 9 wherein the support shaft includes a sleeve portion defined
20 by one end of the shaft and a mounting within the shaft, the trolley having a vertically extending column over which the sleeve portion of the shaft is disposed with the mounting engaging the top of the column.
7. Apparatus according to claim 10 wherein the
25 support shaft comprises a number of sections telescoped together so that the length of the support shaft is

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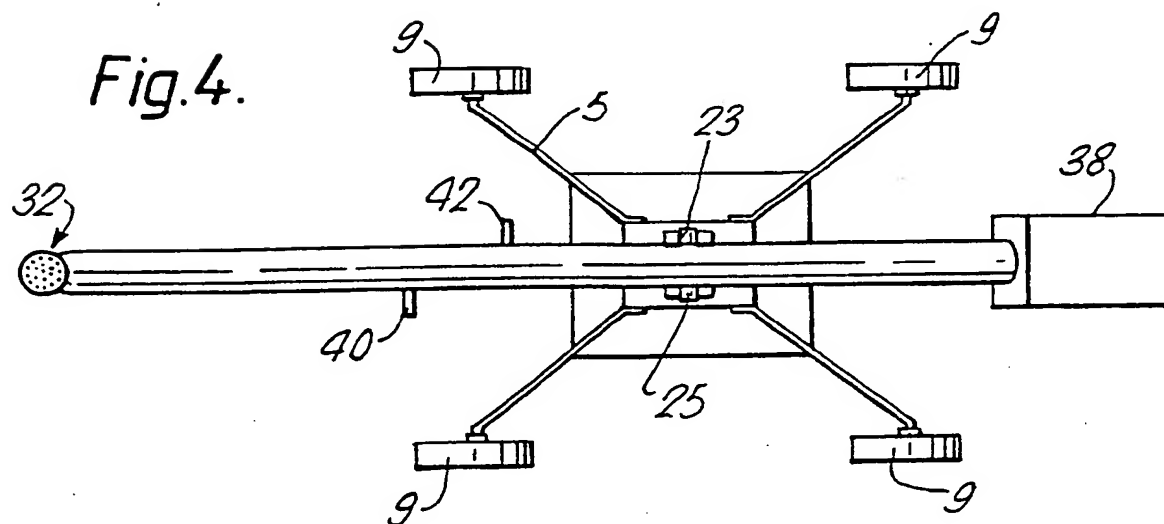
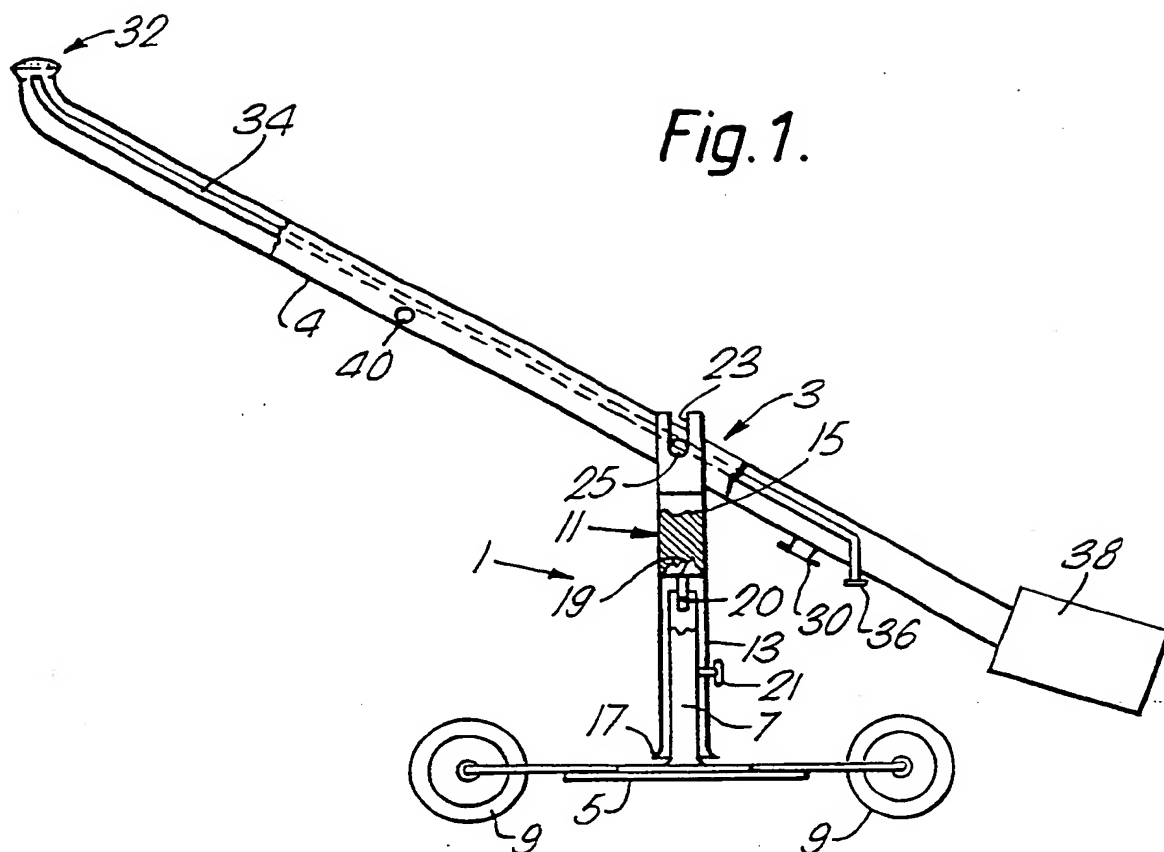
adjustable.

8. Apparatus according to claim 10 or 11 wherein the mounting is adapted so that the support shaft is removable from the trolley and a plurality of different
5 lengths of shafts is provided.

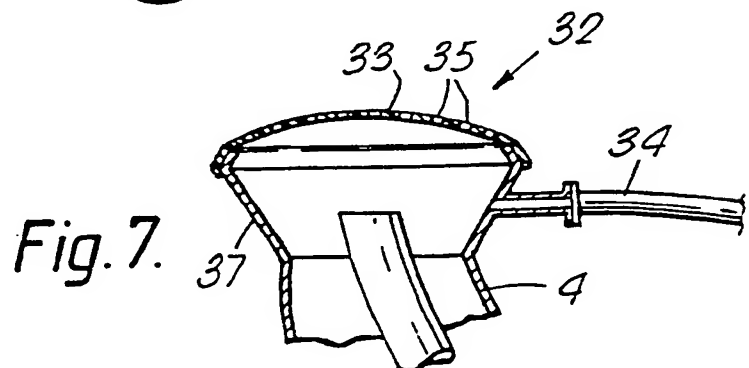
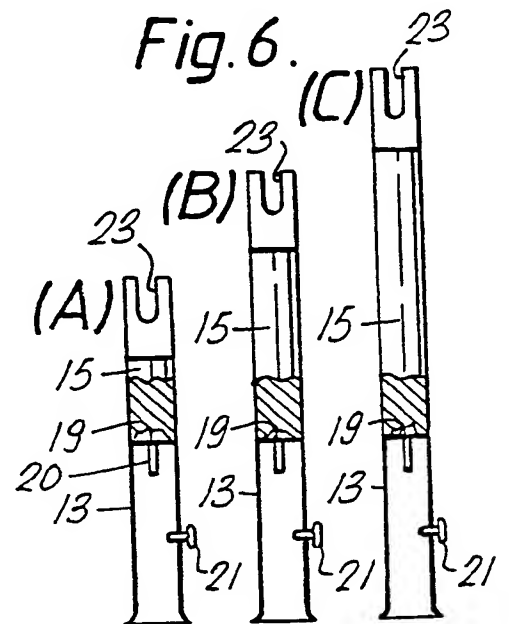
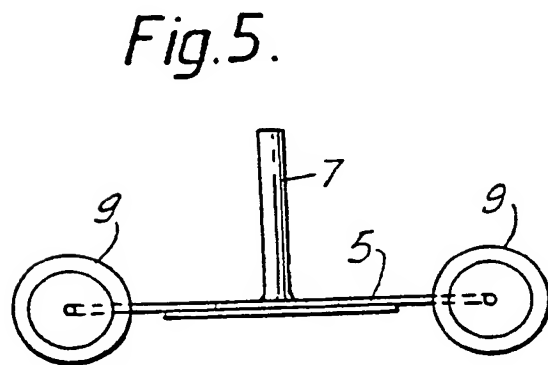
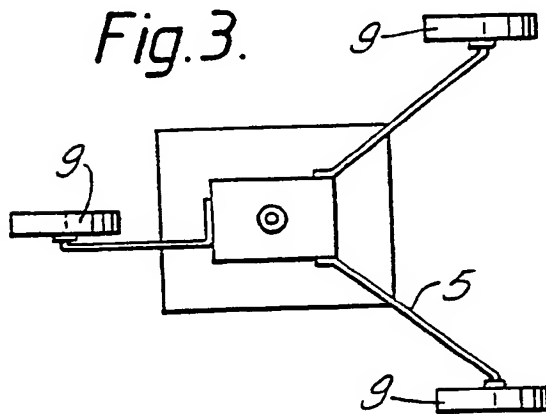
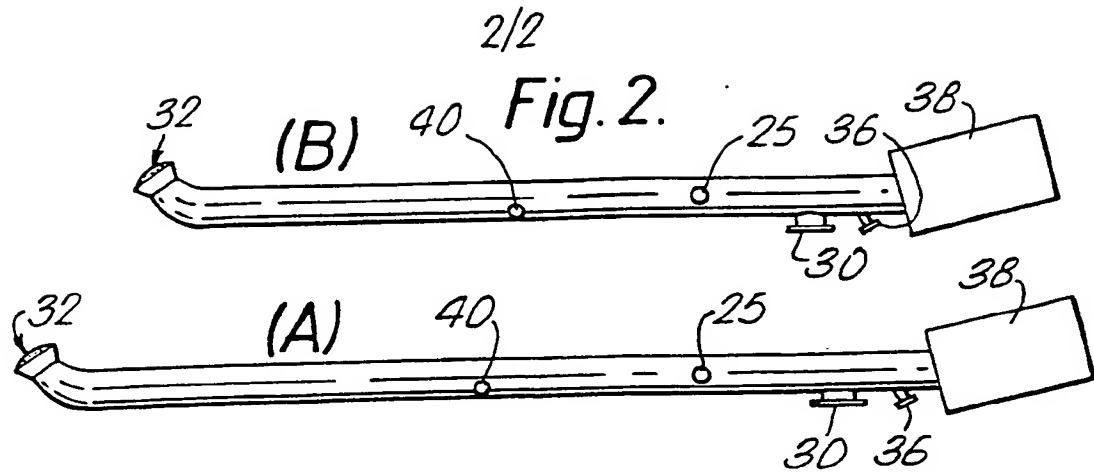
9. Apparatus according to any one of the preceding claims wherein the boom is provided with a counter-weight on the opposite end of the boom from the spray head.

10. Apparatus according to claim 25 wherein the
10 volume is defined by a bowl and a resilient cap, the aperture being provided in the cap.

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SUBSTITUTE SHEET



INTERNATIONAL SEARCH REPORT

International Application No **PCT/GB 89/00585**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁴ : E 04 F 21/12, E 04 G 21/04, B 05 B 15/08																															
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">IPC⁴</td> <td style="padding: 5px;">E 04 F, E 04 G, B 05 B</td> </tr> </table> <div style="border-top: 1px solid black; padding-top: 5px;"> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸ </div>			Classification System	Classification Symbols	IPC ⁴	E 04 F, E 04 G, B 05 B																									
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category ¹⁰</th> <th style="width: 70%; border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; border-bottom: 1px solid black;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">GB, A, 1566932 (KUROSAKI REFRACTORIES CO. LTD) 8 May 1980 see page 2, line 37 - page 3, line 96; figures 1-7</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-3,5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">7</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">US, A, 2331373 (CAMPBELL) 12 October 1943 see page 1, left-hand column, line 34 - page 2, right-hand column, line 57; figures 1-6</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-3</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">US, A, 3957203 (BULLARD) 18 May 1976 see column 2, line 25 - column 4, line 41; figures 1-6</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,3,5,6</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; vertical-align: top; padding: 5px;">.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">4,7</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">2</td> </tr> <tr> <td colspan="3" style="text-align: center; padding: 5px;">./.</td> </tr> </table> <div style="font-size: small; padding: 5px;"> <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%; vertical-align: top;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p> </td> </tr> </table> </div>			Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	GB, A, 1566932 (KUROSAKI REFRACTORIES CO. 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IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 26th July 1989 </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report 23. 08. 89 </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;"> International Searching Authority EUROPEAN PATENT OFFICE </td> <td style="border-bottom: 1px solid black; padding: 5px;"> Signature of Authorized Officer M. VAN MOL </td> </tr> </table>			Date of the Actual Completion of the International Search 26th July 1989	Date of Mailing of this International Search Report 23. 08. 89	International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer M. VAN MOL																									
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
X	US, A, 3061201 (RIENECKER) 30 October 1962 see column 1, line 70 - column 4, line 5; figures 1,2,4	1,3,5,9
Y	--	7
Y	GB, A, 1151173 (SCHWING) 7 May 1969 see page 2, lines 24-111; figures 1-5	4
A	--	1,5
A	DE, A, 1683535 (SCHLECHT) 18 September 1969 see page 3, line 11 - page 4, line 25; figures	1,10

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 8900585

SA 28962

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 10/08/89. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		JP-A- 52127408	26-10-77
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DE-A- 1683535	18-09-69	None	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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